Amendments to the Claims

This listing of claims replaces all prior versions of the claims in the patent application:

Claim 1 (currently amended): A method for spatially interpolating an image, the method comprising using a dedicated interpolation neural network for each of a plurality of different edge directions to provide an interpolated value of the image.

Claim 2 (withdrawn): A method for spatially interpolating an image, the method comprising training a neural network to interpolate for an edge direction and then using that neural network to interpolate when approximately the same edge direction is determined.

Claim 3 (withdrawn): A method for spatially interpolating an image, the method comprising associating a plurality of neural networks with a corresponding plurality of edge directions by training each neural network to interpolate a value based upon the associated edge direction.

Claim 4 (currently amended): A method for spatially interpolating an image, the method comprising the steps of:

determining an edge direction of an image at a location within the image where interpolation is desired;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the image at the location using the selected interpolation neural network.

Claim 5 (original): The method as recited in claim 4, wherein determining an edge direction comprises determining vector correlations between pixels on adjacent scan lines such that the location where interpolation is desired is between the adjacent scan lines.

Claim 6 (withdrawn): The method as recited in claim 4, further comprising determining

whether or not a viable edge direction exists, prior to selecting a neural network and when no viable edge direction exists, then selecting a neural network which was trained to interpolate when no viable edge direction exists.

Claim 7 (currently amended): The method as recited in claim 4, wherein selecting an interpolation neural network comprises the steps of determining which of a plurality of different interpolation neural networks is most closely associated with the determined edge direction.

Claim 8 (withdrawn): The method as recited in claim 4, wherein selecting a neural network comprises the steps of determining which of a plurality of different neural networks is best trained to interpolate a value of the image for the determined edge direction.

Claim 9 (currently amended): The method as recited in claim 4, wherein selecting an interpolation neural network comprises the steps of mirroring a data set to facilitate use of a common neural network for symmetric edge directions.

Claim 10 (currently amended): The method as recited in claim 4, wherein selecting an interpolation neural network comprises the steps of vertically mirroring a data set to facilitate use of a common neural network for symmetric edges.

Claim 11 (currently amended): The method as recited in claim 4, wherein selecting an interpolation neural network comprises the steps of selecting a substantially linear neural network with one neuron.

Claim 12 (withdrawn): The method as recited in claim 4, further comprising the steps of training a plurality of neural networks, wherein each neural network is trained to interpolate a value of an image for a predetermined edge direction.

Claim 13 (original): The method as recited in claim 4, further comprising the steps of repeating the determining, selecting and interpolating steps so as to provide a new scan line between two

old scan lines.

Claim 14 (original): The method as recited in claim 4, further comprising repeating the determining, selecting and interpolating steps so as to provide a new scan line between two old scan lines in order to facilitate deinterlacing.

Claim 15 (original): The method as recited in claim 4, wherein the location where interpolation is desired is defined by a pixel in the image.

Claim 16 (original): The method as recited in claim 4, wherein the interpolated value is intensity.

Claim 17 (original): The method as recited in claim 4, wherein the interpolated valued is color.

Claim 18 (original): The method as recited in claim 4, wherein the edge direction is determined by correlating at a vector from one scan line proximate the location where interpolation is desired with a vector from another scan line proximate the location where interpolation is desired.

Claim 19 (original): The method as recited in claim 4, wherein the edge direction is determined by correlating at a vector from a scan line immediately above the location where interpolation is desired with a vector from another scan line immediately below the location where interpolation is desired.

Claim 20 (original): The method as recited in claim 4, wherein the location where interpolation is desired is between two scan lines of a video image.

Claim 21 (original): The method as recited in claim 4, wherein the location where interpolation is desired is between two scan lines of a field of an interlaced video image.

Claim 22 (original): The method as recited in claim 4, wherein the location where interpolation

is desired is approximately centered between two scan lines of an interlaced video image.

Claim 23 (original): The method as recited in claim 4, wherein the location where interpolation is desired is approximately centered between two scan lines of an interlaced video image and further comprising enhancing the video image with the interpolated value so as to facilitate formation of a deinterlaced video image.

Claim 24 (currently amended): The method as recited in claim 4, wherein inputs to the selected interpolation neural network comprise values of neighboring portions of the image with respect to the location where interpolation is desired.

Claim 25 (currently amended): The method as recited in claim 4, wherein inputs to the selected interpolation neural network comprise values of neighboring pixels with respect to a pixel at the location where interpolation is desired.

Claim 26 (currently amended): The method as recited in claim 4, wherein:

determining an edge direction comprises selecting one of 2[[N]]*n*+1 different edge directions;

selecting an interpolation neural network comprises selecting one of N+3 interpolation neural networks; and

N+1 of the interpolation neural networks are used for interpolation when an edge direction can be configuring determined, and one of the interpolation neural networks is used for interpolation when an edge exists and the edge direction cannot be determined, and one interpolation neural network is used when there is no edge.

Claim 27 (currently amended): The method as recited in claim 4, wherein between approximately 40 and approximately 80 samples are provided as inputs to the interpolation neural network.

Claim 28 (currently amended): The method as recited in claim 4, wherein approximately

60 samples are provided on inputs to the interpolation neural network.

Claim 29 (withdrawn): The method as recited in claim 4, wherein the neural network is trained.

Claim 30 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a portion of an image to the neural network.

Claim 31 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a portion of an image to the neural network with the weighting coefficients initially set to zero.

Claim 32 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a portion of an image to the neural network with a bias value initially set to zero.

Claim 33 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a vertically low pass filtered portion of an image to the neural network.

Claim 34 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a portion of an image to the neural network, the portion of the image being low pass filtered along a vertical direction to mitigate vertical components which are substantially beyond a capability of the neural network to interpolate.

Claim 35 (withdrawn): The method as recited in claim 4, further comprising training the neural network by providing a portion of an image to the neural network and using a back propagation algorithm to vary parameters of the neural network.

Claim 36 (withdrawn): The method as recited in claim 4, further comprising training the

neural network by providing a portion of an image to the neural network and using a back propagation algorithm to vary parameters of the neural network, the back propagation algorithm using a least mean square procedure as a learning algorithm.

Claim 37 (currently amended): A system for spatially interpolating an image, the system comprising a dedicated interpolation neural network configured to provide an interpolated value for each of a plurality of different edge directions in the image.

Claim 38 (withdrawn): A system for spatially interpolating an image, the system comprising:

a plurality of neural networks, each neural network configured to interpolate a value of the image for a predetermined edge direction;

an edge direction detector configured to determine an edge direction of an image at a location within the image where interpolation is desired; and

a neural network selector responsive to the edge direction detector and configured to select one of the neural networks based upon the determined edge direction.

Claim 39 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to determine an edge direction by determining vector correlations between pixels on adjacent scan lines wherein the location is between the adjacent scan lines.

Claim 40 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to determine whether or not a viable edge direction exists prior to selecting a neural network and when no viable edge direction exists then selecting a neural network which was trained to interpolate when no viable edge direction exists.

Claim 41 (withdrawn): The system as recited in claim 38, wherein the neural network selector is configured to select a neural network by determining which of a plurality of different neural networks is most closely associated with the determined edge direction.

Claim 42 (withdrawn): The system as recited in claim 38, wherein the neural network selector is configured to select a neural network comprises determining which of a plurality of different neural networks is best trained to interpolate a value of the image for the determined edge direction.

Claim 43 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to mirror a data set to facilitate use of a common neural network for symmetric edge directions.

Claim 44 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to vertically mirror a data set to facilitate use of a common neural network for symmetric edges.

Claim 45 (withdrawn): The system as recited in claim 38, wherein the neural network comprises a substantially linear neural network with one neuron.

Claim 46 (withdrawn): The system as recited in claim 38, wherein each neural network is trained to interpolate a value of an image for a predetermined edge direction.

Claim 47 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to determine an edge direction by correlating at a vector from one scan line proximate the location where interpolation is desired with a vector from another scan line from proximate the location where interpolation is desired.

Claim 48 (withdrawn): The system as recited in claim 38, wherein the edge direction detector is configured to determined an edge direction by correlating a vector from a scan line immediately above the location where interpolation is desired with a vector from another scan line immediately below the location where interpolation is desired.

Claim 49 (currently amended): A method for interpolating an omitted scan line between

two neighboring scan lines of an interlaced image, the method comprising detecting an edge direction of the image at a selected point on the omitted scan line, selecting an interpolation neural network based upon the detected edge direction, and using the interpolation neural network to provide an interpolated value for the selected point.

Claim 50 (currently amended): A method for deinterlacing a video image, the method comprising:

determining an edge direction of a video image at a location within the video image where interpolation is desired, the location being intermediate two adjacent scan lines of a field of the video image;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the video image at the location using the selected interpolation neural network.

Claim 51 (original): The method as recited in claim 50, further comprising repeating the determining, selecting and interpolating steps so as to provide a new scan line between two old scan lines.

Claim 52 (withdrawn): A device for interpolating an omitted line between two neighboring scan lines of an interlaced image, the device comprising an edge detector configured to detect an edge direction of the image at a selected point on the omitted line, and a plurality of neural networks, each neural network configured to interpolate a value for the omitted line when a particular edge direction has been detected.

Claim 53 (currently amended): A system for deinterlacing a video image, the system comprising:

a plurality of interpolation neural networks, each neural network configured to interpolate a value of the video image for a predetermined edge direction;

an edge direction detector configured to determine an edge direction of an image at a location within the video image where interpolation is desired; and

an interpolation neural network selector responsive to the edge direction detector and configured to select one of the interpolation neural networks based upon the determined edge direction.

Claim 54 (currently amended): A display monitor comprising:

a system for deinterlacing a video image, the system for deinterlacing a video image comprising:

a plurality of interpolation neural networks, each interpolation neural network configured to interpolate a value of the video image for a predetermined edge direction;

an edge direction detector configured to determine an edge direction of an image at a location within the video image where interpolation is desired; and

an interpolation neural network selector responsive to the edge direction detector and configured to select one of the interpolation neural networks based upon the determined edge direction.

Claim 55 (currently amended): An image produced using a method for spatial interpolation, the method for spatial interpolation comprising:

determining an edge direction of an image at a location within the image where interpolation is desired;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the image at the location using the selected interpolation neural network.

Claim 56 (currently amended): A deinterlaced video image produced using a method for deinterlacing, the method for deinterlacing comprising:

determining an edge direction of an interlace video image at a location within the image intermediate two adjacent scan lines of a field of the video image;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the video image at the location using the selected interpolation neural network.

Claim 57 (withdrawn): A method for training a neural network, the method comprising:

providing a non-interlaced image;

interlacing the image to form an interlaced image;

providing at least a portion of the interlaced image to the neural network;

determining an edge direction in the interlaced image at a location within the interlaced image;

selecting a neural network based upon the determined edge direction;

interpolating a value of the interlaced image at the location using the selected neural network;

comparing the interpolated value with a value from a corresponding location of the non-interlaced image to define an error value; and

modifying the selected neural network based upon the error value.

Claim 58 (withdrawn): The method as recited in claim 57, further comprising vertically low pass filtering the interlaced image prior to comparing the interpolated value with a value from the corresponding location of the non-interlaced image.

Claim 59 (withdrawn): A device for training a plurality of neural networks to deinterlace an image, the device comprising:

an interlacer configured to interlace a non-interlaced image and to communicate the interlaced image to a neural network;

a vertical low pass filter configured to vertically low pass filter the non-interlaced image;

a comparator configured to compare an interpolated value from the neural network to a corresponding value of the non-interlaced image from the vertical low pass filter and to provide an error signal representative of a difference between the interpolated value and the corresponding value; and

a back propagation path configured to communicate the error signal from the comparator to the neural network to facilitate modification of the neural network.

Claim 60 (currently amended): A medium for storing information, the medium having stored thereon a method for spatial interpolation, the method for spatial interpolation comprising:

determining an edge direction of an image at a location within the image where interpolation is desired;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the image at the location using the selected interpolation neural network.

Claim 61 (currently amended): A medium for storing information, the medium having stored thereon an image produced using a method for spatial interpolation, the method for spatial interpolation comprising:

determining an edge direction of an image at a location within the image where interpolation is desired;

selecting an interpolation neural network based upon the determined edge direction; and

interpolating a value of the image at the location using the selected interpolation neural network.